

Appln. No.: 10/809,775
Amendment Dated: August 14, 2007
Reply to Office Action of: April 18, 2007

MAT-8526US

Amendments to the Drawings:

The attached sheets of drawings include changes to Figures 1, 4, 13, 15, 16, 17 and 18. These sheets replace the original sheets.

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Remarks/Arguments:

Claims 8 and 9 have been cancelled and new claims 20 and 21 have been added. No new matter has been added.

On page 2 of the Office Action, the Examiner objects to Figs. 1, 4, 13, and 15-18. All blocks in the Figures have been labeled with identifiable descriptors as per request of the Examiner. Withdrawal of the objection is respectfully requested.

On page 3 of the Office Action, the Examiner objects to the title of the invention as being not descriptive. The title of the invention has been modified to read "IMAGE PROCESSOR WITH SHARPNESS ENHANCEMENT." Withdrawal of the objection is respectfully requested.

The Examiner has objected to claim 15 which is a method claim that is dependent on apparatus claim 1. Method claim 15 has been amended to now depend on method claim 11. Withdrawal of the objection is respectfully requested.

Dependent claims 2 and 12 are objected to because they refer to a "enhancing value" which is not defined in the claims upon which they depend. The term "enhancing value" has been replaced with the term "enhancing degree" which can be found in independent claims 1 and 11. Withdrawal of the objection is respectfully requested.

On page 4 of the Office Action, the Examiner rejects claims 3 and 13 under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, the Examiner states that it is structurally very difficult to interpret the claims. On page 5 of the Office Action, the Examiner has proposed an interpretation of the claims for purposes of examination. Applicants do not agree with the Examiner's interpretation and have therefore amended claims 3 and 13 for further clarification. Claims 3 and 13, as presently amended, are fully compliant with 35 U.S.C. § 112. Withdrawal of the § 112 rejection is respectfully requested.

The present invention relates to an image processor with sharpness enhancement. Sharpness enhancement is implemented by expanding a color distribution of an image in a direction of a first primary component.

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On page 6 of the Office Action, the Examiner rejects claims 1, 4-6, 11 and 14-16 under 35 U.S.C. § 102(e) as being anticipated by Kokemohr (US 2004/0036923 A1). On page 8 of the Office Action, the Examiner has rejected claims 2, 3, 12 and 13 under 35 U.S.C. § 103(a) as being unpatentable over Kokemohr and Kwon (U.S. Patent No. 4,945,502). It is respectfully submitted, however, that the claims are patentable over the art of record for the reasons set forth below.

Kokemohr teaches a digital image sharpening system. Kokemohr's system teaches an enhancing process which calculates the difference between an image and a blurred image. Furthermore, Kwon teaches a digital image sharpening method using singular value decomposition. Kwon teaches expanding the color distribution of an image based on multiple singular values.

Applicants' invention, as recited by claim 1, includes a feature which is neither disclosed nor suggested by the art of record, namely:

... expanding a distribution in a direction of a first primary component without expanding the distribution in a direction of a second or third primary component ...

Claim 1 relates to an enhancing process that expands a color distribution of an image only in the direction of a first primary component. This feature is found in the originally filed application at page 11, lines 14-15, and furthermore, in Fig. 5A. No new matter has been added.

In paragraph 18, Kokemohr discloses an enhancing process ("calculating a luminosity difference between the luminosity of the pixels of the digital image and luminosity of the pixels of the blurred image"). Kokemohr's teachings are similar to Applicants' claim 1 where sharpness enhancing is recited ("enhancing processing unit for carrying out a sharpness enhancing process on the input image") and furthermore, on page 10, lines 8-21 of Applicants' specification ("enhancing processing unit 107 carries out a sharpness enhancing process"). Kokemohr, however, does not teach the sharpness enhancing process to expand the distribution in the direction of a first principal component analysis value. This deficiency of Kokemohr is acknowledged on page 9, lines 1-5 of the Office Action. Applicants' claim 1 is different than Kokemohr, because of the expansion of distribution of an image as recited in claim 1 ("expanding a distribution in a

direction of a first primary component without expanding the distribution in the direction of a second or third primary component").

In column 2, lines 29-34, Kwon teaches a sharpening process that utilizes singular value decomposition ("singular values that are closely analogous to the concept of principal component analogous"). Furthermore, in column 2, lines 61-63, Kwon teaches expanding a distribution with respect to **multiple singular values** ("the non-linear gain function is applied to the singular values to produce an array of singular values"). Kwon's teachings are similar to Applicants' claim 1 where expanding a distribution is recited ("expanding a distribution in a direction of a first primary component without expanding the distribution in a direction of a second or a third primary component"), and furthermore, on page 11, lines 14-22 of Applicants' specification ("to expand only the first primary component value in the color component direction. Should the color distribution be expanded ... in a direction other than the first primary component axis ... the image will become an image enhanced in noise"). Applicants' claim 1 is different than Kwon, because **of the expansion of the distribution in the direction of a first primary component without certain other expansions** as recited in claim 1 ("expanding a distribution in a direction of a first primary component without expanding the distribution in a direction of a second or third primary component"). Applicants' expansion technique takes into account the direction of a color that sharpness is to enhance within the color space. By expanding the color distribution in the direction of the first primary component and not the second or the third primary component, it is possible to obtain a sharpened image **without enhancing the noise**. It is noted that expanding the color distribution in a second primary component axis or a third primary component axis the image would become an image enhanced in noise. This enhancing process can be found in Applicants' specification on page 11, line 22, and furthermore, in Fig. 5B.

Because neither Kokemohr nor Kwon disclose "expanding a distribution in a direction of a first primary component without expanding the distribution of in a direction of a second or third primary component," neither Kokemohr nor Kwon, nor their combination, disclose or suggest all of the features of Applicants' currently amended claim 1.

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It is because Applicants include the feature of "expanding a distribution in a direction of a first primary component without expanding the distribution in a direction of a second or third primary component," that the following advantages are achieved. An advantage is the ability to sharpen an image without enhancing the noise in the image. Accordingly, for the reasons set forth above, claim 1 is patentable over the art of record.

Independent claims 10 and 11 have been similarly amended to claim 1. Thus, claims 10 and 11 are also patentable over the art of record for the reasons set forth above.

Claims 2-7 include all of the features of claim 1 from which they depend. Thus, claims 2-7 are also patentable over the art of record for the reasons set forth above.

Claims 12-19 include all of the features of claim 11 from which they depend. Thus, claims 12-19 are also patentable over the art of record for the reasons set forth above.

In view of the amendments and arguments set forth above, the above identified application is in condition for allowance which action is respectfully requested.

Respectfully submitted,



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Attachments: Figures 1, 4, 13, 15, 16, 17 and 18 (7 sheets)

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